SCIENCE

AN ILLUSTRATED JOURNAL

PUBLISHED WEEKLY

VOLUME XV

JANUARY—JUNE 1890

NEW YORK
N. D. C. HODGES
1890

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SCIENCE

[Entered at the Post-Office of New York, N.Y., as Second-Class Matter.]

A WEEKLY NEWSPAPER OF ALL THE ARTS AND SCIENCES.

EIGHTH YEAR.
VOL. XV. NO. 361.

NEW YORK, JANUARY 3, 1890.

SINGLE COPIES, TEN CENTS.
$3.50 PER YEAR, IN ADVANCE.

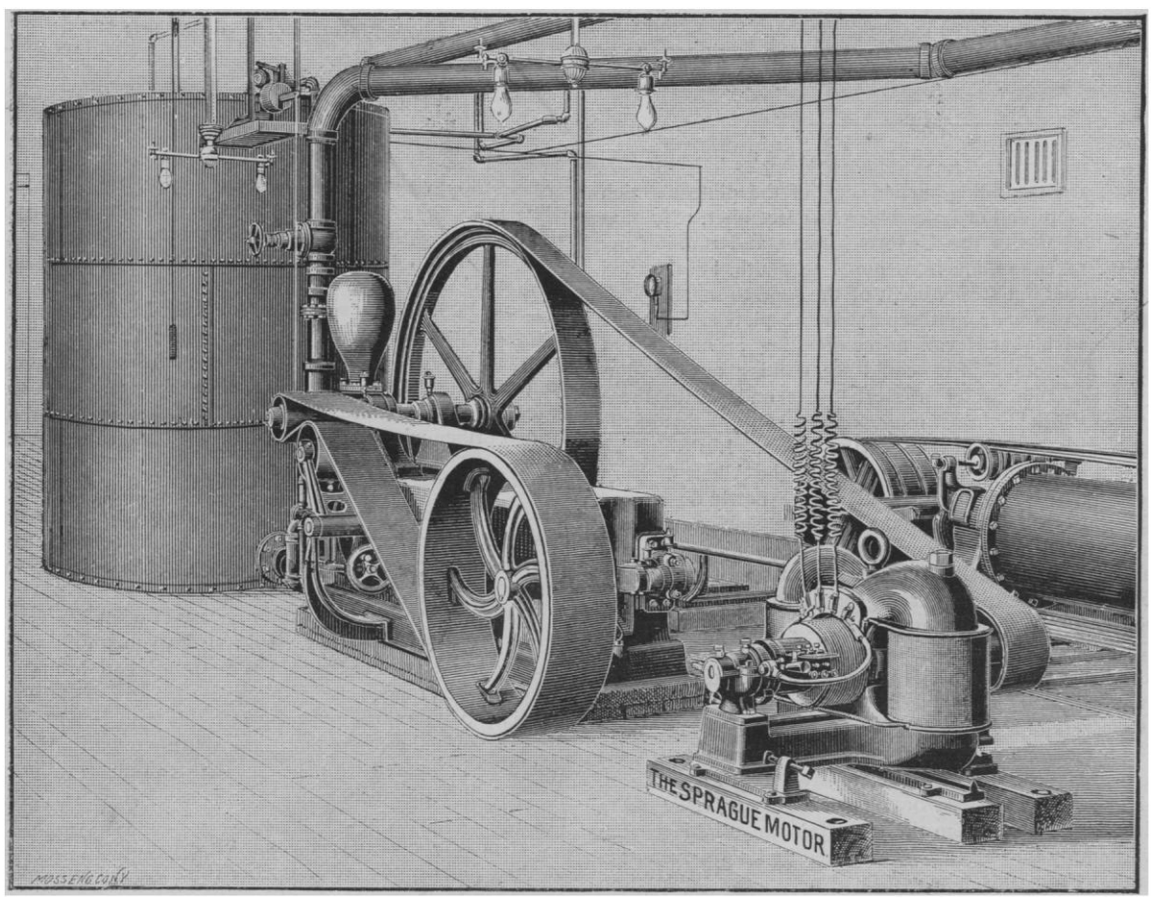
MODEL ELECTRIC ELEVATOR INSTALLATION.

WE present in this issue a view of a recent model hydraulic elevator installation made at the building of the United Security, Trust, and Safe Deposit Company of Philadelphia by the Otis Elevator Company of Yonkers, N.Y., and Chadbourne, Hazleton, & Co. of Philadelphia, agents in Pennsylvania for the Sprague Electric Railway and Motor Company.

One of the first things which strikes an observer is the minimum of space required for every part of the installation. The pump was manufactured by the Otis Elevator Company specially for this plant, and the arrangement for reduction of speed between the armature-shaft and the pump is made in the compact manner shown in the illustration. The motor operates the pump against a pressure in the tank, there being no overflow; and when the maximum pressure is reached, the motor runs empty, automatically cutting down the amount of electric current taken from the line, so that only sufficient current is used to supply enough energy to keep the motor in revolution.

Before the installation of the electric motor at this place, a gas-engine was used to supply the necessary power; but gas never proved satisfactory in this capacity, and the Sprague motor was substituted.

This motor is now giving perfect satisfaction, and the plant is one of the finest elevator plants in Philadelphia. Our view is made from a photograph, and shows all the details of the installation.



A NEW ELECTRIC ELEVATOR.

THE WORLD'S MEAT CONSUMPTION, PRODUCTION, AND TRADE.

THE average consumption of meat in the world, says a recent number of the *Journal of the Society of Arts*, London, has increased; but, on the other hand, the world's commerce in meat has declined. Germany's imports of meat declined from $94,450,000 in 1878, to $73,700,000 in 1887, while the exports declined from $88,300,000 to $33,900,000. In France, between 1879 and 1887, imports diminished from $82,300,000 to $53,910,000, while exports increased from $35,950,000 to $52,600,000. In England, where exports of meat are insignificant, the imports decreased from $240,000,000 in 1880, to $215,000,000 in 1887. On the other hand, the British colonies exported largely: for example, from Canada the exports increased from $4,430,000 in 1879, to $30,000,000 in 1887.

Australia exported also large amounts. In Austria-Hungary, imports diminished from $10,950,000 in 1879, to $8,000,000 in 1887, while exports increased from $20,750,000 to $33,900,000. In the United States, imports increased from $7,100,000 in 1879, to $16,650,000 in 1887, while exports decreased from $128,800,000 to $112,600,000. Importations into Belgium decreased from $16,400,000 in 1879, to $10,400,000 in 1887; in Italy, from $21,200,000 to $14,000,000; in Russia, from $18,330,000 to $10,400,000. By adding the above figures, it is found that the entire imports of meat into the countries specified have diminished from $490,970,000 to $403,120,000, while the entire exports decreased from $278,180,000 to $244,700,000. In 1875, Germany possessed 24,400,000 neat-cattle (four small cattle, such as sheep, hogs, and goats, being reckoned as one); in 1883, only 23,500,000. Between 1881 and 1887 there was in France an increase from 19,700,000 to 20,750,000; in Great Britain, from 17,800,000 to 18,600,000; while in Austria-Hungary the figures remained the same. The increase in population in these countries during this time was as follows: in Germany, 3,500,000; France, 480,000; Great Britain, about 3,000,000; and Austria-Hungary, 2,000,000. The ratio in France on account of the small increase of population is most favorable. This country, therefore, could increase its exports, says the United States commercial agent. In Germany the ratio is very bad, the number of neat-cattle having diminished 900,000 head, and the population having increased 3,500,000. It is most remarkable in the case of the United States, where imports increased 130 per cent, and exports diminished 12½ per cent, although the number of neat-cattle increased from 56,600,000 head in 1880, to 71,200,000 in 1888, and the population increased only from 50,500,000 to 62,000,000.

STANLEY'S EXPLORATIONS.[1]

I REMEMBER, while standing on the edge of the plateau which overlooks the southern end of Lake Albert, in December, 1887, that looking across the lake to the Unyoro plateau, and running my eye along its unbroken outline from north to south, I was much struck by the gradual but steady uplift of the land to a point near the lake's end, where a wide cleft separated the plateau from the lisjointed mass and higher elevations culminating around Mount Ajif. Southward beyond Ajif we could see nothing but dark impenetrable clouds, ominous of a storm; yet underneath these night-black clouds lurked a most interesting mystery, — that of the long-lost and wandering Mountains of the Moon. Little did we imagine it, but the results of our journey from the Albert Nyanza to Unyampaka, where I turned away from the newly discovered lake in 1876, establish beyond a doubt that the snowy mountain which bears the native name of Ruwenzori or Ruwenjura is identical with what the ancients called "Mountains of the Moon."

Note what Scheaddeddim, an Arab geographer of the fifteenth century, writes: "From the Mountains of the Moon the Egyptian Nile takes its rise. It cuts horizontally the equator in its course north. Many rivers come from this mountain and unite in a great lake. From this lake comes the Nile, the most beautiful and greatest of the rivers of all the earth."

If, adopting the quaint style and brevity of the Arab writer, we would write of this matter now, we would say, "From Ruwenzori, the Snow Mountain, the western branch of the Upper Nile takes its rise. Many rivers come from this mountain, and, uniting in the Semliki River, empty into a great lake, named by its discoverer the Albert Nyanza. From this lake, which also receives the eastern branch of the Upper Nile, issues the true Nile, one of the most famous of the rivers of all the earth."

But this is a matter of slight moment compared to the positive knowledge that in the least-suspected part of Africa there has shot up into view and fact a lofty range of mountains, the central portion of which is covered with perpetual snow, which supplies a lake to the south of the equator, and pours, besides, scores of sweet-water streams to the large tributary feeding the Albert Nyanza from the south.

You will remember that Samuel Baker, in 1864, reported the Albert Nyanza to stretch "illimitably" in a south-westerly direction from Vacovia; and that Gessi Pacha, who first circumnavigated that lake, and Mason Bey, who in 1877 made a more careful investigation of it, never even hinted at the existence of a snowy mountain in that neighborhood; nor did the two last travellers pay any attention to the Semliki River. I might even add that Emin Pacha, for years resident on or near Lake Albert, or Capt. Cassati, who for some months resided in Unyoro, never heard of any such remarkable object as a snowy mountain being in that region: therefore we may well call it an unsuspected part of Africa. Surely it was none of our purpose to discover it. It simply thrust itself direct in our homeward route, and, as it insisted on our following its base-line, we viewed it from all sides but the north-east. Only then could we depart from its neighborhood.

Surrounded as I am by the hourly wants of an expedition like this, I cannot command the time to write such a letter on this subject as I would wish. I must even content myself with allowing a few facts to fall into line for your leisurely consideration.

If you will draw a straight line from the debouchure of the Nile from Lake Albert, 230 geographical miles in a direction nearly south-west, magnetic, you will have measured the length of a broad line of subsidence, which is from 20 to 50 miles wide, that exists between 3° north latitude and 1° south latitude in the centre of the African continent. On the left of this great trough, looking northward of course, there is a continuous line of upland, rising from 1,000 to 3,000 feet above it. Its eastern face drops abruptly into the trough: the western side slopes gently to the Ituri and Lomva basins. To the right there is another line of upland. The most northerly section, 90 miles, rising from 1,000 to 3,000 along the trough, is the Unyoro plateau, whose western face almost precipitously falls into the trough, and whose eastern face slopes almost imperceptibly towards the Kafur. The central section, also 90 miles long, consists of Ruwenzori range, from 4,000 to 15,000 above the average level of the trough. The remaining section of upland, and the most southerly, is from 2,000 to 3,500 feet higher than the trough, and consists of the plateaus of Uhaiyana, Unyampaka, and Ankori.

The most northerly section of the line of subsidence, 90 miles in length, is occupied by the Albert Nyanza; the central section, also 90 miles, by the Semliki River valley; the southernmost portion, 50 miles long, by the plains and New Nyanza, which we have all agreed to name the Albert Edward Nyanza, in honor of the first British prince who has shown a decided interest in African geography.

You will observe, then, that the Semliki valley extends along the base of Ruwenzori range; that the northern and southern extremities or flanks of Ruwenzori have each a lake abreast of it; that the Semliki River runs from the upper to the lower lake in a zigzag course.

If you were to make a plan *in relievo* of what has been described above, the first thing that would strike you would be, that what had been taken out of that abyss or trough had been heaped up in the enormous range; and if along its slope you were to channel out sixty-two streams emptying into this trough, and let the sides of the trough slope here and there sharply towards the centre, you would be impressed with the fact that Ruwenzori was slowly being washed into the place whence it came. However, all these are matters for geologists.

For months all Europeans on this expedition, before setting out on their journey towards Zanzibar from the Albert Lake, were exercised in their minds how Sir Samuel Baker, standing on a hill near Vacovia, five or six miles from the extremity of the Nyanza, could attach "illimitability" to such a short reach of water; but after rounding the Balegga Mountains, which form a group to the south of Kavalli, we suddenly came in view of the beginning of the Semliki valley, — a sight which caused officers to ask one another, "Have you seen the Nyanza?" and the female portion of the Egyptian following to break out into rapturous "Lu-lu-lus." Yet we were only four miles away from the valley, which was nearly white with its ripe grass, and which indeed resembled strongly the disturbed waters of a shallow lake.

This part of the Semliki valley, which extends from the lake south-westerly, is very level: for 30 miles it only attains to an alti-

[1] Letter from Mr. Henry M. Stanley to the Royal Geographical Society of London and to the Royal Scottish Geographical Society, written from Camp at Kizinga Uzinya, Aug. 17, 1889.

tude of 50 feet above the lake. All this part can only recently have been formed; say, the last few hundred years. In one of its crooked bends nearer the south-eastern range, we stumbled suddenly upon the Semliki River, with an impetuous volume, from 80 to 100 yards wide, and an average depth of 9 feet. Its continually crumbling banks of sandy loam rose about 6 feet above it. One glance at it revealed it to be a river weighted with fine sediment. When we experimented, we found a drinking-glass full of water contained nearly a teaspoonful of sediment. We need not wonder, then, that for miles the south end of Lake Albert is so shallow that it will scarcely float a row-boat.

Beyond the grassy portion of the valley, a few acacias begin to stud it, which, as we proceed south-westerly, become detached groves, then a continuous thin forest, until it reaches the dense and rank tropical forest, with tall trees joined together by giant creepers, and nourishing in its shade thick undergrowths. Every thing now begins to be sloppy wet; leaves and branches glisten with dew; weeping mosses cover stem, branch, and twig. The ground is soaked with moisture: a constant mist rises from the fermenting bosom of the forest. In the morning it covers the valley from end to end, and during the early hours, stratum after stratum rises, and, attracted by the greater drought along the slant of Ruwenzori slopes, drifts upwards until the summits of the highest mountains are reached, when it is gradually intensified until the white mist has become a storm-cloud, and discharges its burden of moisture amid bursts of thunder and copious showers.

The valley sensibly rises faster in the forest region than in the grassy part. Knolls and little rounded hills crop out, and the ground is much more uneven. Violent streams have ploughed deep ravines round about them, and have left long narrow ridges, scarcely a stride across at the summit, between two ravines a couple of hundred feet deep. At about 75 miles from the Albert Nyanza the valley has attained about 900 feet of altitude above it, and at this junction the forest region abruptly ends. The south-west angle of Ruwenzori is about east of this, and with the change of scene a change of climate occurs. We have left eternal verdure, and the ceaseless distillation of mist and humid vapors into rain, behind, and we now look upon grass ripe for the annual fire and general droughtiness. From this place the valley becomes like a level grassy plain until the Albert Edward Nyanza is reached.

The southernmost stretch of the Ruwenzori range projects like a promontory between two broad extents of the ancient bed of the Albert Edward. To avoid the long *détour*, we cross this hilly promontory in a south-easterly direction from the Semliki valley, and enter eastern Usongora, and are in a land as different from that at the north-western base of Ruwenzori as early summer is from mid-winter. As we continue easterly, we leave Ruwenzori on our left now, and the strangely configured Albert Edward Nyanza on our right. The broad plains which extend between were once covered by this lake. Indeed, for miles along its border there are breadths of far-reaching tongues of swamp penetrating inland. Streams of considerable volume pour through these plains toward the Nyanza from Ruwenzori, without benefiting the land in the least. Except for its covering of grass, — at this season withered and dried, — it might well be called a desert; yet in former times, not very remote, the plains were thickly peopled. The zeribas of milk-weed, and dark circles of *Euphorbia*, wherein the shepherds herded their cattle by night, prove that, as well as the hundreds of cattle-dung mounds we come across. The raids of the Waganda and the Warasura have depopulated the land of the Wasongora, the former occupants, and have left only a miserable remnant, who subsist by doing work for the Warasura, their present masters.

From Usongora we enter Toro, the Albert Edward Nyanza being still on our right, and our course being now north-easterly, as though our purpose was to march to Lake Albert again. After about 20 miles' march, we turn east, leave the plains of the Albert Edward, and ascend to the uplands of Uhaiyana, which having gained, our course is south until we have passed Unyampaka, which I first saw in 1876.

South of Unyampaka stretches Ankori, a large country, and thickly peopled. The plains have an altitude of over 5,000 feet above the sea, but the mountains rise to as high as 6,400 feet. As Ankori extends to the Alexandra Nile, we have the well-known land of Karagwé south of this river.

Since leaving the Albert Nyanza, between Kavalli and the Semliki River, we traversed the lands of the Wavira and Babegga. On crossing the Semliki, we entered the territory of the Awamba. When we gained the grassy terrace at the base of the Ruwenzori range, we travelled on the border-line between the Wakonju, who inhabit the lower slopes of Ruwenzori, and the Awamba, who inhabit the forest region of the Semliki valley. The Wakonju are the only people who dwell upon the mountains. They build their villages as high as 8,000 feet above the sea. In time of war — for the Warasura have invaded their country also — they retreat up to the neighborhood of the snows. They say that once fifty men took refuge right in the snow region, but it was so bitterly cold that only thirty returned to their homes. Since that time they have a dread of the upper regions of their mountains.

As far as the south-west angle of Ruwenzori, the slopes of the front line of hills are extensively cultivated. The fields of sweet-potatoes, millet, eleusine, and plantations of bananas, describe all kinds of squares, and attract the attention; while between each separate settlement the wild banana thrives luxuriantly, growing at as high an altitude as the summits of the highest spurs, whereon the Wakonju have constructed their villages.

Though we were mutually hostile at first, and had several little skirmishes, we became at last acquainted with the Wakonju, and very firm, close friends. The common enemy were the Warasura; and the flight of the Warasura, upon hearing of our advance, revealed to the Wakonju that they ought to be friends with all those who were supposed to be hostile to their oppressors. Hence we received goats, bananas, and native beer in abundance. Our loads were carried, guides furnished us, and every intelligence of the movements of the Wanyoro brought us. In their ardor to engage the foe, a band of them accompanied us across Usongora and Toro to the frontier of Uhaiyana.

South-west of Awamba, beyond the forest region of the Semliki valley, begins Usongora. This country occupies the plains bordering the north-west and north of Lake Albert Edward. The people are a fine race, but in no way differing from the finer types of men seen in Karagwé and Ankori, and the Wahuma shepherds of Uganda. Their food consists of milk and meat, the latter eaten raw or slightly warmed.

The Toro natives are a mixture of the higher class of Negroes, somewhat like the Waganda. They have become so amalgamated with the lower Wanyoro that we can find nothing distinctive. The same may be said of the Wahaiyana. What the royal families of these tribes may be, we can only imagine from having seen the rightful prince of Usongora in Ankori, who was as perfect a specimen of a pure Galla as could be found in Shoa. But you need not conclude from this that only the royal families possess fine features. These Ethiopic types are thickly spread among the Wahuma of these Central African uplands. Wherever we find a land that enjoys periods of peace, we find the Wahuma at home, with their herds; and in looking at them one might fancy one's self transported from the midst of Abyssinia.

Ankori is a land which, because of its numbers and readiness to resistance, enjoys long terms of uninterrupted peace; and here the Wahuma are more numerous than elsewhere. The royal family are Wahuma: the chiefs, and all the wealthier and more important people, are pure Wahuma. Their only occupation, besides warring when necessary, is breeding and tending cattle. The agricultural class consists of slaves; at least, such is the term by which they are designated. The majority of the Wahuma can boast of features quite as regular, fine, and delicate as Europeans.

The countries to the south of the Albert Edward are still unexplored, and we have not heard much respecting them; but what we have heard differs much from that which you find illustrated by that irregular sheet of water called Muta Nzige, in the "Dark Continent" map.

Ruanda bears the name of Unyavingi to the people of Ukonju, Usongora, and Ankori, and is a large compact country lying between the Alexandra Nile and the Kongo watershed to the west, and reaching to within one day's long march of the Albert Edward. It also overlaps a portion of the south-west side of that lake. The

people are described as being very warlike, and that no country, not even Uganda, could equal it in numbers or strength. The late queen has been succeeded by her son, Kigeri, who now governs.

Since the commencement of our march homewards from our camp at Kavalli, we have undergone remarkable vicissitudes of climate. From the temperate and enjoyable climate of the region west of Lake Albert, we descended to the hot-house atmosphere of the Semliki valley, at nearly 3,000 feet lower level. Night and day were equally oppressively warm and close, and one or two of us suffered greatly in consequence. The movement from the Semliki valley to the plains north of Lake Albert brought us to a dry but a hot land. The ground was baked hard; the grass was scorched; the sun, but for the everlasting thick haze, would have been intolerable; in addition to which, the water — except that from the Ruwenzori streams — was atrocious, and charged with nitre and organic corruption. The ascent to the eastern plateau was marked by an increase of cold and many an evil consequence, — fevers, colds, catarrhs, dysenteries, and paralysis. Several times we ascended to over 6,000 feet above the sea, to be punished with agues, which prostrated black and white by scores. In the early mornings, at this altitude, hoar-frost was common. Blackberries were common along the path in North-West Ankori, 5,200 feet above the sea-level.

On entering Uzinya, south-west corner of Lake Victoria, the health of all began to improve, and fevers became less common.

I have jotted these few remarks down very hastily. Whether it is from lack of wholesome food or not, I confess to feeling it an immense labor to sit down and write upon any subject. I do not agree with Shakspeare when he says —

> "Fat paunches have lean pates; and dainty bits
> Make rich the ribs, but bankrupt quite the wits."

In our case, and I speak for all our officers as well as myself, "dainty bits" just now would brighten up our wits, for we suspect that our wits have strongly sympathized with the bodies' pains.

That you may know what the upper regions of Ruwenzori are like, I send you Lieut. Stairs's account of his ascent to a height of nearly 11,000 feet.

[Lieut. Stairs's account, written from Expedition Camp, June 8, 1889.]

I have the honor to present you with the following account of an attempt made by me to reach the snow-capped peaks of Ruanzori: —

Early on the morning of the 6th of June, accompanied by some forty Zanzibaris, we made a start from the expedition's camp at the foot-hills of the range, crossed the stream close to camp, and commenced the ascent of the mountain.

With me I had two aneroids, which together we had previously noted and compared with a standard aneroid remaining in camp under your immediate observation; also a Fahrenheit thermometer.

For the first 900 feet above camp the climbing was fairly good, and our progress was greatly aided by a native track which led up to some huts on the hills. These huts we found to be of the ordinary circular type so common on the plains, but with the difference that bamboo was largely used in their interior construction. Here we found the food of the natives to be maize, bananas, and colocasia roots. On moving away from these huts, we soon left behind us the long rank grass, and entered a patch of low scrubby bush, intermixed with bracken and thorns, making the journey more difficult.

At 8.30 A.M. we came upon some more huts of the same type, and found that the natives had decamped from them some days previously. Here the barometer read 23″.58 and 22″.85; the thermometer, 75° F. On all sides of us we could see *Dracænas*, and here and there an occasional tree-fern and Mwab palm; and tangled in all shapes, on either side of the track, were masses of long bracken. The natives now appeared at different hill-tops and points near by, and did their best to frighten us back down the mountain by shouting and blowing horns. We, however, kept on our way up the slope, and in a short time they disappeared, and give us very little further trouble.

Of the forest plains, stretching far away below us, we could see nothing, owing to the thick haze that then obscured every thing. We were thus prevented from seeing the hills to the west and north-west.

At 10.30 A.M., after some sharp climbing, we reached the last settlement of the natives, which consisted of beans and colocasias, but no bananas. Here the barometer read 22″.36; thermometer, 84° F. Beyond this settlement was a rough track leading up the spur to the forest. This we followed; but in many places, to get along at all, we had to crawl on our hands and knees, so steep were the slopes.

At 11 A.M. we reached this forest, and found it to be one of bamboos, at first open, and then getting denser as we ascended. We now noticed a complete and sudden change in the air from that we had just passed through. It became much cooler and more pure and refreshing, and all went along at a faster rate and with lighter hearts. Now that the Zanzibaris had come so far, they all appeared anxious to ascend as high as possible, and began to chaff each other as to who should bring down the biggest load of the "white stuff" on the top of the mountain.

At 12.40 P.M. we emerged from the bamboos, and sat down on a grassy spot to eat our lunch: barometers, 21″.10 and 27 $\frac{95}{120}$″; thermometer, 70° F. Ahead of us, and rising in one even slope, stood a peak, in altitude 1,200 feet higher than we were. This we now started to climb, and, after going up it a short distance, came upon the tree heaths. Some of these bushes must have been 20 feet high; and, as we had to cut our way foot by foot through them, our progress was necessarily slow, and very fatiguing to those ahead.

At 3.15 we halted among the heaths for a few moments to regain our breath. Here and there were patches of inferior bamboos, almost every stem having holes in it, made by some boring insect, and quite destroying its usefulness. Under foot was a thick spongy carpet of wet moss, and the heaths on all sides of us we noticed were covered with Old Man's Beard. We found great numbers of blue violets and lichens, and from this spot I brought away some specimens of plants for the Pacha to classify. A general feeling of cold dampness prevailed. In spite of our exertions in climbing, we all felt the cold mist very much. It is this continual mist clinging to the hill-tops that no doubt causes all the vegetation to be so heavily charged with moisture, and makes the ground under foot so wet and sloppy.

Shortly after 4 P.M. we halted among some high heaths for camp. Breaking down the largest bushes, we made rough shelters for ourselves, collected what firewood we could pick up, and in other ways made ready for the night. Firewood, however, was scarce, owing to the wood being so wet that it would not burn. In consequence of this, the lightly clad Zanzibaris felt the cold very much, though the altitude was only about 8,500 feet. On turning in, the thermometer registered 60° F. From camp I got a view of the peaks ahead, and it was now that I began to fear we should not be able to reach the snow. Ahead of us, lying directly in our path, were three enormous ravines. At the bottoms of at least two of these there was dense bush. Over these we should have to travel, and cut our way through the bush. It then would resolve itself into a question of time as to whether we could reach the summit or not. I determined to go on in the morning, and see exactly what difficulties lay before us, and, if these could be surmounted in a reasonable time, to go on as far as we possibly could.

On the morning of the 7th, selecting some of the best men, and sending the others down the mountain, we started off again upwards, the climbing being similar to that we experienced yesterday afternoon. The night had been bitterly cold, and some of the men complained of fever; but all were in good spirits, and quite ready to go on. About 10 A.M. we were stopped by the first of the ravines mentioned above. On looking at this, I saw that it would take a long time to cross, and there were ahead of it still two others. We now got our first glimpse of a snow-peak, distant about two and a half miles, and I judged it would take us still a day and a half to reach this the nearest snow. To attempt it, therefore, would only end disastrously, unprovided as we were with food, and some better clothing for at least two of the men.

I therefore decided to return, trusting all the time that at some future camp a better opportunity for making an ascent would present itself, and the summit be reached. Across this ravine was a bare, rocky peak, very clearly defined, and known to us as the south-west of the Twin Cones. The upper part of this was devoid of vegetation, the steep beds of rock only allowing a few grasses and heaths in one or two spots to exist.

The greatest altitude reached by us, after being worked out and all corrections applied, was 10,677 feet above the sea. The altitude of the snow-peak above this would probably be about 6,000 feet, making the mountain, say, 16,600 feet high. This, though, is not the highest peak in the Ruanzori cluster. With the aid of the field-glass, I could make out the form of the mountain-top perfectly. The extreme top of the peak is crowned with an irregular mass of jagged and precipitous rock, and has a distinct crater-like form. I could see, through a gap in the near side, a corresponding rim or edge on the farther, of the same formation and altitude. From this crown of rock, the big peak slopes to the eastward at a slope of about 25°, until shut out from view by an intervening peak; but to the west the slope is much steeper. Of the snow, the greater mass lay on that slope directly nearest us, covering the slope wherever its inclination was not too great. (The largest bed of snow would cover a space measuring about 600 by 300 feet, and of such depth that in only two spots did the black rock crop out above its surface. Smaller patches of snow extended well down into the ravine.) The height from the lowest snow to the summit of the peak would be about 1,200 feet or 1,000 feet. To the east-north-east our horizon was bounded by the spur, which, starting directly behind our main camp, and mounting abruptly, takes a curve in a horizontal plane, and centres on to the snow-peak. Again, that spur which lay south of us also radiated from the two highest peaks. This would seem to be the general form of the mountain; namely, that the large spurs radiate from the snow-peaks as a centre, and spread out to the plains below. This formation on the west side of the mountain would cause the streams to start from a centre, and flow on, gradually separating from each other, until they reach the plains below. There they turn to the west-north-west, or trace their courses along the bottom spurs of the range, and run into the Semliki River, and on to the Albert Nyanza. Of the second snow-peak which we had seen on former occasions, I could see nothing, owing to the Twin Cones intervening. This peak is merely the termination, I should think, of the snowy range, we saw when at Kavalli's, and has a greater elevation, if so, than the peak we endeavored to ascend. Many things go to show that the existence of these peaks is due to volcanic causes. The greatest proof that this is so lies in the numbers of conical peaks clustering round the central mass and on the western side. These minor cones have been formed by the central volcano getting blocked in its crater, owing to the pressure of its gases not being sufficient to throw out the rock and lava from its interior; and consequently the gases, seeking for weak spots, had burst through the earth's crust, and thus been the means of forming these minor cones that now exist. Of animal life on the mountain, we saw almost nothing. That game of some sort exists, is plain from the number of pitfalls we saw on the road-sides, and from the fact of our finding small nooses in the natives' huts, such as those used for taking ground game. We heard the cries of an ape in a ravine, and saw several dull grayish-brown birds like stonechats; but beyond these, nothing.

We have found blueberries and blackberries at an altitude of 10,000 feet and over, and I have been able to hand over to the Pacha some specimens for his collections, the generic names of which he has kindly given me, and which are attached below. That I could not manage to reach the snow, and bring back some as evidence of our work, I regret very much; but to have proceeded onwards to the mountain under the conditions in which we were situated, I felt would be worse than useless, and, though all of us were keen and ready to go on, I gave the order to return. I then read off the large aneroid, and found the hand stood at 19″.900. I set the index-pin directly opposite to the hand, and we started down hill. At 3 P.M. on the 7th I reached you, it having taken four hours and a half of marching from the Twin Cones. The following are the generic names of the plants collected by me. Emin Pacha has kindly furnished them. 1. *Clematis;* 2. *Viola;* 3. *Hibiscus;* 4. *Impatiens;* 5. *Tephrosia;* 6. *Elycina;* 7. *Rubus;* 8. *Begonia;* 9. *Peucedanum;* 10. *Gnaphalium;* 11. *Helichrysum;* 12. *Senecio;* 13. *Sonchus;* 14. *Vaccinium;* 15. *Erica arborea;* 16. *Landolphia;* 17. *Heliotropium;* 18. *Lantana;* 19. *Moschosma;* 20. *Lissochilus;* 21. *Dracœna;* 22. *Luzula;* 23. *Carex;* 24. *Anthesteria;* 25. *Adiantum;* 26. *Pellœa;* 27. *Pteris aquilina;* 28. *Asplenium;* 29. *Aspidium;* 30. *Polypodium;* 31. *Lycopodium;* 32. *Selaginella;* 33. *Marchantia;* 34. *Parmelia;* 35. *Usnea;* 36. Tree fern; 37. One fern; 38. One *Polypodium.* The generic names of the last three are unknown.

PHONETICS.[1]

I CONGRATULATE the Modern Language Association on the establishment of a section which is as indispensable to language as the character of the Prince of Denmark is to the play of Hamlet. Language lives in sound; and the study of modern languages is the study of the spoken tongues.

I was honored by appointment to the presidency of this section, not in virtue of any linguistic attainments, but simply in recognition of my long and minute study of practical phonetics. At this the first meeting of our Phonetic Section, a few words on that subject will not, I trust, be unwelcome.

We constantly hear of the difficulty in pronouncing a foreign language, and especially of the difficulty of our own language to foreigners; but the reason of the difficulty has not been sufficiently recognized, namely, that learners have no initiatory phonetic training. They try to imitate speech in the mass; and they fail, because, after our earliest years, the faculty of imitation is no longer an instinct, as it is in childhood. The child unfailingly adjusts its organs of speech to the production of whatever sound it is accustomed to hear, and no difficulty is experienced in the process. The youth and the man cannot do so, however, because their organs are already set for the pronunciation of one class of sounds, and they cannot readily alter the adjustment to suit the production of other varieties; that is, they cannot form new sounds in the verbal combinations of speech, but (and this is the point I wish to bring out) they can, or they can be readily taught to, produce any sound by itself. This power is a prerequisite for the certain result of facility in combining the new sound with others as fluently as by a speaker "to the manner born;" for what is called combination is in reality merely rapid sequence.

I have known persons who had long been familiar with Welsh speakers, utterly unable to pronounce the sound of *ll* in a word, but they have been taught in a few seconds to give the element its true native effect, by itself, and, after brief exercise, to give it and an associated vowel the rapidity of sequence which is called combination. We all know speakers who cannot pronounce the English *w* in *we;* but we do not any of us know a single such speaker who cannot at once be made to pronounce the element by itself, and within a few minutes to give it and the succeeding vowel the necessary rapidity of sequence to convert *w-e* into *we*. On the same principle, the German *w*, which English imitators pronounce *v*, can be readily acquired as an elementary sound by any person, and then syllabically connected with vowels exactly as by native speakers.

The sound of *th* is another shibboleth to those who do not possess it in their vernacular. Habit and association have fixed the false method acquired in early undirected attempts, and the wretched mispronunciation is continued year after year. Yet this supposed difficult sound can be pronounced as an element almost at the first effort by any of these speakers, and its combination in syllables be afterwards mastered with certainty.

The only difficult part of English pronunciation is in the application of what is called "accent," which gives a definiteness and stress to some one out of any group of syllables, and a feebleness and indefiniteness to all the other syllables in the group. Accent (or syllabic light and shade) is the most marked characteristic of English utterance, and generally the last to be acquired by a foreigner; yet there is no real difficulty in mastering even this accen-

[1] Address by Dr. A. Melville Bell before the Modern Language Association, at the first session of the Phonetic Section.

tual habit, by simply practising syllables in unison with taps of the fingers. The broken English of foreigners who have been long resident in our midst is due entirely to phonetic neglect, and not to any inherent difficulty in the sounds of the language.

I can foresee that this statement will be called in question, because many teachers of languages have to be included among the speakers of broken English. Nevertheless, the fact remains, that such speakers labor under a disability which might have been prevented, and which may still be removed, by application of the principle that the separate formation of any element, in any given way, is feasible by any person, and that elementary combination is merely elementary sequence.

One result of this principle is to show the pre-eminent importance of the study of phonetic elements. Another result is to show the necessity of some means of indicating these elements independently of ordinary letters, because the latter have already, in all our minds, fixed associations with certain sounds. We require some symbols for pure phonetic qualities, — analogous to the Arabic ciphers for numbers, the algebraic signs, and the notation for music. We want characters which have an absolute value in the mouth — in all mouths — to enable us to teach and discuss the sounds of our respective languages, and to express our exact meaning in regard to them. We do not want to apply such signs instead of letters and in substitution for alphabetic writing, but we want to use them in interpretation of letters. The attempt to interpret letters by other letters is never free from ambiguity.

The symbols which make up what I call "Visible Speech" are precisely such as here described. They constitute a universal alphabet, because by means of them the sounds of any language are expressed with such directiveness that they can be reproduced from the writing by any expert in the system. But the main function of the symbols is fulfilled when they have taught the learner the phonetic value of ordinary letters. Our familiar *A B C*, the German alphabet, the Greek, the Arabic, and every other system of letters, may be preserved unchanged, while the symbols of "Visible Speech" are available as a key to them all.

In one of the early experiments with the system, the professor of Oriental languages in the University of Edinburgh dictated some peculiar East Indian words which were entirely new to me when I wrote them; and, when they were reproduced by the boys who were then the sole interpreters of the system, Professor Reid declared that he could not get his students to pronounce the same words with similar accuracy, after six months' instruction.

In this case the young readers heard the words for the first time when they themselves pronounced them. The explanation is, that the symbolic writing exhibited to their initiated eye the organic mechanism of the sounds, and they had only to follow this, and the original effect was necessarily reproduced without thought of sound on their part, or of any thing but the organic positions.

Some very interesting and crucial tests were applied by Mr. Alexander John Ellis, — the one man in England competent to apply such tests, as he was the author of the most exact analysis of speech-sounds, and the most complete phonetic alphabet that had then been published. I quote Mr. Ellis's own description of the experiments: —

"The mode of procedure was as follows: Mr. Bell sent his sons, who were to read the writing, out of the room, — it is interesting to know that the one who read all the words in this case had only had five weeks' instruction in the use of the alphabet, — and I dictated slowly and distinctly the words which I wished to be written. These consisted of a few words in Latin, pronounced first as at Eton, then as in Italy, and then according to some theoretical notions of how the Latins might have uttered them. Then came some English provincialisms and affected pronunciations; the words 'how odd' being given in several distinct ways. Suddenly German provincialisms were introduced; then discriminations of sounds often confused, in Polish, German, Dutch, and Swiss words; French and English words, and German and French words; some Arabic, some Cockney English, with an introduced Arabic guttural, some mispronounced Spanish, and a variety of shades of vowels and diphthongs. The result was perfectly satisfactory; that is, Mr. Bell wrote down my queer and purposely exaggerated pronunciations and mispronunciations, and delicate distinctions, in such a manner that his son, not having heard them, so uttered them as to surprise me by the extremely correct echo of my own voice. Accent, tone, drawl, brevity, indistinctness, were all reproduced with surprising accuracy. Being on the watch, I could, as it were, trace the alphabet in the lips of the reader. I think, then, that Mr. Bell is justified in the somewhat bold title which he has assumed for his mode of writing, — 'Visible Speech.'"

Mr. Ellis subsequently had the whole phonetic theory of the system, and the plan of symbolization, explained to him, when he had the magnanimity to write, —

"Mr. Melville Bell's scheme will, I believe and hope, thoroughly supersede one on which I have labored for many years, and expended much money."

I venture to say that the whole history of authorship does not exhibit a course of action more altruistic and honorable than that of Alexander John Ellis in his reception of "Visible Speech."

Mr. Ellis, of course, embodied the classifications of "Visible Speech" in his subsequent works. His system of "Glossotype" or "Glossic" was designed for the purpose of enabling all the new phonetic distinctions to be represented by Roman letters. This it accomplished by inversions and other arrangements of the letters, making up an alphabet, complete but arbitrary, and consequently difficult to use without constant reference to tables. "Glossotype" is a translation of "Visible Speech" into letters that are to be found in every printing-office. It, of course, entirely lacks the grand characteristic of "Visible Speech;" namely, self-interpreting letters, which exhibit in their forms a symbolic record of what the mouth must do in order to pronounce their sounds. "Glossotype" may be correctly described as "'Visible Speech' without its visibility."

My speaking to you here in Harvard reminds me that when I paid my first visit to America, in 1868, the then president of this university, Dr. Thomas Hill, was, I found, much interested in "Visible Speech," and in phonetics generally. I had the honor of meeting in Dr. Hill's drawing-room a gathering of professors and others, whom he had invited to receive some demonstrations of the system. To my surprise, Dr. Hill showed himself almost as well acquainted with my system as I was myself. I wrote on the blackboard for his interpretation, and he wrote for mine. Yet he had had no oral instruction in the method, but had studied it entirely from the written description.

I mention these facts simply to encourage those of you who may not have already entered on the study, to make practical investigation for yourselves. In this way you will, at all events, acquire a knowledge of the varieties of linguistic sound, and also see the organic formation of familiar elements, which you may possibly have been forming all your lives without knowing how you formed them; and the power of analyzing familiar sounds will ultimately become a guide to the formation of new and unfamiliar sounds.

We live in a busy world, and cannot afford to spend much time, even in the most interesting studies, unless they involve also our material interests. I may therefore point out, that a knowledge of the whole round of speech-actions can be acquired, under proper oral instruction, in a period so brief that the busiest student need not be deterred from undertaking the work. The study is in itself most interesting, and it is, besides, of important material benefit to those who master it. In primary schools, in schools for the deaf, and in all the fields of teaching, there is an increasing demand for skilled phoneticians; and to you, members of the Modern Language Association, this demand naturally looks for supply.

I am most desirous, before I leave the world, to see the subject of phonetics added to the curriculum in universities and normal schools. I may add, that, in furtherance of this object, I have presented, through the Bureau of Education, and with the kind cooperation of the commissioner of education, a copy of my recent work on "Vocal Physiology and Visible Speech," to every university and normal school in the United States. The same presentation has also been extended to the universities and normal schools in Great Britain and the British Colonies. The opening of this Phonetic Section of the Modern Language Association may be taken as an indication of the growing interest in the subject, and an omen of its future prominence among educational studies.

You will, of course, have many aspects of phonetics presented to

you in the contributions you will receive from year to year, — such as historical phonetics, or the order of past changes in pronunciation; national phonetics, or the tendencies of individual languages; formal phonetics, or the operation of definite laws; assimilative phonetics, or the influence of sound upon sound; and doubtless other varieties, — but all these should pre-imply a fundamental power in practical phonetics. Theorizing on sounds which you cannot illustrate is profitless.

Sounds have been described as long, short, acute, grave, flat, sharp; heavy, light, dull, obscure, hard, soft; harsh, smooth, open, shut, thick, thin; narrow, broad, fat, liquid, etc.; and organically as labial, lingual, palatal, guttural, nasal, dental, head sounds, throat sounds, chest sounds, even ventral sounds. The whole nomenclature has been indefinite and unscientific. Such names must be discarded for a terminology that shall express something which is uniformly intelligible to all who use it.

For example: certain mouth-actions are produced with, and certain others without, accompanying voice: these are clearly distinguished as "vocal" and "non-vocal." Certain actions are performed by the back of the tongue, others by the top of the tongue, others by the front of the tongue, others by the point of the tongue, others by the lips; and the resulting elements are unambiguously named "back," "top," "front," "point," "lip." Some sounds are formed with the tongue in close approximation to the roof of the mouth, others with the tongue removed from it as far as possible, and others in an intermediate position: these varieties are clearly distinguished as "high," "low," "mid." Some sounds are formed with constriction of the organic aperture, and others with comparative looseness and expansion; and these are distinguished by the term "wide" applied to the latter class. Some sounds issue through a channel over the centre of the organ concerned, others through apertures formed at the sides, and some with the mouth-passage entirely closed: the last are descriptively named "shut;" and the side-aperture sounds, "divided." Some sounds are formed with the co-operation of two parts of the mouth, and these are called "mixed;" and some are emitted wholly or partly through the nose. The former are called "nasal;" the latter, "nasalized." Such definite nomenclatures as these are easily learned, readily remembered, and unambiguously understood.

One practical application of phonetics will probably come occasionally under the consideration of this section; namely, the removal of anomalies and irregularities in spelling. This association may well become the national authority and umpire in questions of what is called "spelling-reform." The established writing of our words is only partially phonetic; and the first point to be determined is, Can it be made wholly so? The answer is both yes and no, — no, if the condition be made to admit no new letters, and to maintain the present aspect of words; yes, if new letters be allowed, and the aspect of words be free to change, without regard to present usage. Written words become pictorial to the eye, and any change of the literal picture destroys for a time the identity of the word. Thus words are both combinations of sounds and combinations of letters. The sound is the original, the real word: the letters form a conventional pictorial word. Are we to retain both in mutual independence, with all the inconvenience which the present arrangement entails, or are we to alter the conventional so as to represent the real? If we agree to disturb the old word-picture, let us make the new one perfectly accord with the word-sound; but that would be to give up historical spelling altogether. If we decide to retain historical spelling, we should then agree on some initiatory scheme, by which the difficulty of learning to read may be importantly lessened, for the benefit of children and of the nations which are acquiring the English tongue.

In an extended English alphabet recently published under the title of "World-English," a method is shown by which the writing of the language is rendered perfectly phonetic, while the aspect of words is changed in the least possible degree consistent with that result. The alphabet is designed only for initiatory use, and to facilitate the learning to read from common letters and common spelling. Some critics have failed to see this limitation of the scheme, and have looked on the proposition as a new attempt at spelling-reform; but, on the contrary, the reason for producing "World English" was to demonstrate, that, so far as learners of the language are concerned, present orthography may remain altogether untouched; and that the literature of England and America need not be rendered foreign to the eye by any change in spelling.

Why cannot our legislatures rise to the importance of regulating school and official practice in the representation of our speech? Private efforts have cleared the way, and shown, in a variety of modes, what may be done. Official action now would be comparatively easy.

In the mean time, might not this association with advantage formulate some conclusions on the subject? Suppose the following questions to be discussed, and the answers promulgated for general information: —

1. Should our spelling be altered for the sake of facilitating the work of learning to read?

2. Can that object be attained without such alteration?

3. Can our spelling be partially phoneticized, by dropping silent letters and otherwise, without destroying the identity of words to the eye?

4. Can a purely phonetic method, in place of ordinary spelling, be made acceptable to the educated public?

5. Should we not recognize two independent forms of our written words, — one in common spelling, for use in literature; the other in phonetic spelling, for use in primary schools, and wherever else may be desired?

Definite answers to these or such questions would tend to concentrate effort in the approved direction, and to suspend futile effort in other directions.

The varieties of sound heard in dialectic and district pronunciation prove that the necessities of intercourse do not depend on nice phonetic distinctions. In fact, one who is familiar with the words of a language can understand speech when only one unchanging vowel-sound is used; or writing, when a mere hyphen is substituted for all vowel-letters. One system of shorthand is based on this principle. The consonants are written small when no vowel-sound follows them; and in this way the relative size of these characters informs the eye where vowels do and do not occur; with the result, that, except in monosyllables, the writing is sufficiently free from ambiguity for practical stenography.

Extended intercourse is assimilating the pronunciation of districts which differed widely in their utterance before the days of steamboats and railways. The dialect of my native place is no longer what it was in my remembrance. The provinces of a nation, and the nations of the world, are rising gradually to one phonetic standard. But variety comes with refinement; shades of sound become associated with shades of meaning; and the ear itself becomes more appreciative of slight differences.

Early English pronunciation was very unlike what we hear now, chiefly because it lacked many shades of sound which we distinguish. The letter *r* had always its consonant sound, which is now heard only before a vowel. *A* was alway *ah; ai, ah-i; aw, ah-w.* *W* was always pronounced after a vowel, as *ew, eh-w; ow, oh-w.* *U*, as in *but* and *us*, was always pronounced *oo;* and our silent letters *gh* and *l*, as in *might* and *would*, were always sounded. I can fortunately illustrate the effect of the English of Shakspeare's time by repeating a short speech, the pronunciation of every word in which has been ingeniously recovered by Mr. Ellis. This is Portia's speech on mercy, from the "Merchant of Venice," as prouounced on the Shakspearian stage ["The quality of mercy," etc.]. My object in this brief address has been simply to incite you to give increased attention to practical phonetics. Mastery of the mouth will give an advantage in all the other departments, and also in the teaching of modern languages. Without entering further into detail, which would make this a lesson instead of an address, I shall conclude by hoping that the deliberations of this Phonetic Section may advance the study of the art and science of speech, enhance both professional and popular interest in the subject, and be a continuous credit to the Modern Language Association.

THE Russian Government has in contemplation a project for connecting, by a system of canals, the White Sea with Lake Onega and with the principal navigable rivers of Russia. The canals are to be of sufficient depth to admit vessels drawing ten feet of water.

HEALTH MATTERS.

The Difficulties of the Medical Profession.

"An Old Doctor" deplores the visible decadence of the profession in a long letter of lamentation in *The Lancet*. Among other things, he says, —

"In these advertising days, in medicine, as in every thing else, people who know little or nothing of a subject, who presume ignorantly to address the public in the daily and weekly press, attract more notice than those who have devoted their lives to their particular work. It is a misfortune that in this country (i.e., England) a very large amount of medical practice (and that the most easy and profitable) is lost to the profession by the fact that almost all chemists prescribe largely. This is a great and crying evil. The practice is, instead of diminishing, largely increasing. This should be stopped. The chemist nearly always prescribes, but generally says, to cover himself, 'If worse, take patient to a medical man.' And so the medical man reaps all the hard work (often without being paid), and the chemist most of the profits. Then, again, hospitals, both special and general, take away largely from the proper, legal, and rightful profits of the profession. The public have a notion that they get advice and medicine of the highest character from the hospitals for nothing, but, if they pay for it to the general practitioner, they get a second-rate article. This is a bad system. Why not set up legal dispensaries for free legal advice, free places to get married in, free clothing establishments, free meat-stores, etc., all paid for by subscriptions or rates?

"The fact is, the medical profession is gradually and surely committing suicide, and its career on the downward path should be promptly arrested. If we were true to ourselves (which we are not, and never have been), the present increase in the profession would be insufficient to supply the needs of the public. But, if we go on working on the 'sweating system,' (for who sweats more, mentally and physically, than the hard-worked medical practitioner, night and day doing his best to preserve the health and life of the people?) often indeed without reward, then we shall be fools indeed. This idea, that medical services can be had for nothing, and so ought to be paid for at that price, is spreading. We are doing away with all professional reserve. We make every thing plain, and it is valued accordingly. The more a profession is lowered in the eyes of the public, the less respect it receives."

The Bacillus of Warts. — Dr. Kuhnemann has found, says *The Medical Record*, in sections of warts (*verruca vulgaris*) a bacillus which is always present in the prickle layer. It has distinctive qualities as regards its capacity for color, and is found both between and in the cells. Its form is that of exceedingly delicate, slender rods, the thickness bearing the proportion to the length of one to six. It is seldom found in the skin surrounding the warts, and is found most plentifully when the wart is recent.

Memory following Cranial Injury. — The following case is reported by the patient, a distinguished member of the legal profession. The loss of memory has been permanent for certain subjects extending over a certain area of time preceding the accident. In all other respects, says *The Medical Analectic*, the mental faculties are of a very high order. "When twelve years and ten months old, I fell over a cliff at Howth, County Dublin. The cause of my accident was a kind of landslip, and I fell and rolled about thirty feet, when I caught a bush, which gave way with me, and I fell about thirty feet more on to rocks. I was picked up quite insensible. My jaw was broken in four places, but no other bones. I am told, however, that my appearance was like that of some one who had been beaten into a jelly from head to foot. I have no recollection of the accident beyond holding on to the bush or bramble which gave way with me. Nor do I remember being picked up, nor any thing which subsequently occurred, until about ten days after the accident, when I seemed to awake out of a long sleep, in great pain, and seeing Surgeon Butcher standing over me and setting my jaw, or doing something to it which caused me great pain. I was more or less incapable of doing any thing for seven or eight months, owing to the shock to my system. My father had died about seven months before the accident; and I am told that I used constantly to be with him, and that he was very fond of me, but I have not the smallest recollection of him, or what he was like, nor can I remember a single incident of my life before the accident; and, in fact, up to the time it occurred, every thing is a complete blank in my memory, both as regards individuals and events. I am told that I was practically insensible for about a week after the accident occurred."

Influenza. — We are now passing through one of the periodic visitations of this annoying disease. For the last four centuries these attacks have come at varying intervals, those most pronounced being at intervals of forty or fifty years, although others have occurred at shorter intervals. These last, however, have been confined to smaller areas, where for some reason the conditions were favorable to the spread of the disease. A peculiarity of the great attacks has been their universality, spreading as they have from the equator to the poles. We are now inclined to connect some micro-organism with each disordered state of the human system. So it may be that this enemy of human comfort has his periods of activity, just as the seventeen-year locust has his. Influenza comes suddenly, and goes as quickly. The cause, whatever it may be, descends on a community with the result that the least robust, of whatever age, are afflicted most. The outbreak of epizootic among horses in 1870 has been connected by some with the influenza in man.

NOTES AND NEWS.

The government of Chili has had a committee of engineers examining the water-works of the principal European cities, with a view to establishing similar works, on a large scale, in some of the Chilian cities.

— Professor R. H. Thurston has received the university decoration, "*Officier de l'Instruction Publique de France.*"

— The canal to connect the North Sea, at the mouth of the Elbe, with the Gulf of Kiel on the Baltic, which was begun two or three years ago, is making fair progress. It will be 61 miles long, 85 feet broad at the bottom, and nearly 200 at the water-level, and of sufficient depth to take the largest German war-vessels. It will have only two locks, one at each end.

— The sixth annual meeting of the American Historical Association was begun in Washington, Dec. 28. Among those present were President Charles K. Adams of Cornell University; the Hon. John Jay of New York; John F. King, president of the New York Historical Society; Dr. Justin Winsor of Cambridge, Mass.; Mrs. Martha J. Lamb, editor of the *Magazine of American History*; Gen. James Grant Wilson of New York; Horatio King, Washington; Gen. George W. Cullom, William F. Poole, Chicago; Senator Hoar, President Gallaudet, of Washington; Judge Chamberlin of Boston; and Gen. Charles Darling of Utica, N.Y. Professor George L. Burr of Cornell University delivered an address on the literature of witchcraft. Ex-President Andrew D. White of Cornell followed in a paper entitled "A Catechism of Revolutionary Reaction." It calls attention to the fact, that, while there are so many histories of the French Revolution, there is as yet no history of the re-actions which have followed it. The next paper was on the "French Revolution in San Domingo," by Herbert Elmer Mills, instructor in history, Cornell University. Clarence Winthrop Bowen, Ph.D., read a paper entitled "A Newly Discovered Manuscript: Reminiscences of the American War of Independence, by Ludwig, Baron von Closen, Aide to Count de Rochambeau." This contained a description of the movements of the allied armies in the neighborhood of Manhattan Island in the summer of 1781, of the meeting of Washington and Rochambeau, and of the scenes following Cornwallis's surrender. The writer gives many interesting personal reminiscences of the Washington family and of early American society. The subject of President Charles K. Adams's inaugural address was "The Recent Advancement of Historical Studies in the Colleges and Universities of America and Europe." Mr. Talcott Williams of Philadelphia read an interesting paper on "Historical Survivals in Morocco." The full programme has already been published.

— A careful computation of the speed of a routing-machine cutter, made recently in Chicago by mechanical experts, showed it to be making 23,466 revolutions per minute. This was the regular

working speed, but the machine is sometimes speeded up to 28,000 revolutions per minute. The magnolia anti-friction metal, mentioned recently in these columns, is used for bearings, which permits this high speed to be maintained for ten hours a day without heating the journals.

— In a recent pamphlet on petroleum-fields, Mr. Charles Marvin states that the oil-fields of Canada cover upward of a hundred thousand square miles. There are also extensive oil-fields, comparatively undeveloped, in South Africa, New Zealand, South Australia, and Burmah. As the South African oil-fields underlie the diamond and gold mining districts, it would seem to be assured of a speedy development, fuel costing nearly a hundred dollars a ton there.

— Mr. Loubat, a member of the New York Historical Society, as we have already noted, has given to the Academie des Inscriptions et Belles-Lettres of Paris, a fund with an annual income of 1,000 francs for the giving of a prize of 3,000 francs every third year. This prize is to be given to the best printed work on history, geography, archæology, ethnography, linguistics, or numismatics of North America. The academy fixes 1776 as the latest date to which the works are to apply. The prize will be awarded in 1892, and any work will be open to the prize if published after July 1, 1889, whether in Latin, French, English, Spanish, or Italian.

— In the manufacture of one or two proprietary articles, Mr. James Gresham of Brooklyn has found it necessary, according to the *Oil, Paint, and Drug Reporter*, to use beeswax, from which he extracts the saccharine and gelatine matters, leaving a fine powder containing all of the other principles of beeswax. This latter substance has always been considered a waste product until lately, when experiments demonstrated its value for polishing fine surfaces, such as furniture, silver, glass, etc. The discovery is considered important, and will no doubt be turned to industrial account instead of the by-product being destroyed, as formerly.

— The Maryland Historical Society has published in a handsome volume the first instalment of the "Calvert Papers," recovered after years of fruitless search, and acquired by the society somewhat more than a year ago. These papers consist of about one thousand documents relating to the Calvert family and to the province of Maryland; and they extend chronologically from the reign of Elizabeth to about ten years before the American Revolution. A large number are of great historical importance and interest. This volume, besides a selection from these documents, gives an account of their recovery and presentation to the society, and a complete calendar, carefully prepared by Mr. J. W. M. Lee, of all the papers recovered. A handsome blazon, in colors, of the arms of Cecilius Calvert, as given in Gwillim, forms the frontispiece.

— At a largely attended meeting in Edinburgh on Tuesday, Dec. 3, it was resolved, we learn from *Nature*, that Mr. George Reid, R.S.A., should be commissioned to paint a portrait of Professor P. G. Tait, to be placed permanently in the rooms of the Royal Society of Edinburgh. A committee was appointed to carry out the resolution, including, among others, Mr. John Murray ("Challenger" expedition), convener; Mr. Gillies Smith, honorary treasurer; Lord President Inglis; Lord Kingsburgh; Lord Maclaren; Sir William Thomson; Sir Arthur Mitchell; Professor Robertson Smith; Professor Chiene; Dr. Alexander Buchan; Mr. Robert Cox; and Mr. William Peddie. It was proposed that an etched engraving of the portrait be prepared for distribution among the subscribers, the plate to be destroyed after the required number of copies have been thrown off. It was further resolved that all the fellows of the Royal Society of Edinburgh, the professor's old pupils, and others, be afforded an opportunity of taking part in this public recognition of Professor Tait's eminent services to science.

— Italy, France, and the United States of America were represented in the elections to foreign membership of the Royal Society of London on Thursday, Dec. 5, according to *Nature*. Professor Stanislao Cannizzaro of Rome was elected on the ground of his researches on molecular and atomic weights; Professor Chauveau of Paris, for his researches on the mechanism of the circulation, animal heat, nutrition, and the pathology of infectious diseases; and Professor Rowland of Baltimore, for his determination in absolute measure of the magnetic susceptibilities of iron, nickel, and cobalt, for his accurate measurements of fundamental physical constants, for the experimental proof of the electro-magnetic effect of electric convection, for the theory and construction of curved diffraction-gratings of very great dispersive power, and for the effectual aid which he has given to the progress of physics in America and other countries.

— French colonization and development companies are making encouraging progress in creating new oases in the Algerian part of the Desert of Sahara. One company have sunk nine artesian wells, reaching water-bearing strata at a depth of 230 feet, giving a steady flow of about five thousand gallons per minute. The water is brackish, and unfit for drinking, but it answers very well for irrigation. This company have about fifty thousand palm-trees under cultivation, the date-palm being the principal variety. Henna and madder are also cultivated profitably, and experiments are in progress with cotton, flax, tobacco, grape-vines, wheat, and barley. Rye-grass and lucern grow abundantly, the latter especially flourishing in the palm-tree plantations. This company began operations in 1882, and they now have upwards of nine hundred acres of productive land reclaimed from the desert, watered by twenty-five miles of irrigating canals. These are very interesting experiments, and it is to be hoped they will be commercially successful, if not extremely profitable.

— The committee on building fund of the Natural Science Association of Staten Island, appointed to consider the possibility of obtaining a fund for a meeting hall, museum, and library, state that they have succeeded, by informal personal solicitation, in obtaining a pledged subscription for that purpose of $100 from each of the following gentlemen: Capt. A. L. King, Eberhard Faber, L. F. Whitin, Dr. N. L. Britton, Aaron Vanderbilt, Henry R. Kunhardt, L. P. Gratacap, Arthur Hollick, and K. B. Newell. The following active members have agreed to become life members (by the payment of $50 each) in order to assist the fund: Dr. Frederick Hollick, Dr. William C. Walser, W. B. Kunhardt. From the above it will be seen that more than $1,000 is definitely pledged at the present time. It was thought best to secure some such amount, as a guaranty of earnestness and good faith, before making a general appeal to the public. The gratifying success has determined the committee to push on with the work, and to publish and distribute a general appeal to the public at an early date, probably during the first part of next month. The sum estimated as necessary to be raised is $7,000.

— A street-railway about a mile and a half in length, on an entirely new principle, is being constructed in Washington, D.C., by the Judson Pneumatic Railway Company of this city. In this system, power is to be transmitted by compressed air from a central station to a series of motors placed beneath the track at intervals of about fifteen hundred feet. In a conduit between the rails, similar in construction to a cable-railway conduit, revolves a smooth cylinder, or series of cylinders coupled together at the ends about six inches in diameter. These cylinders are to be kept in continuous rotation by the compressed-air motors. An adjustable blade or arm projecting from the bottom of the car, and passing through the narrow slot into the conduit, carries at its end a group of friction-wheels, which may be pressed down forcibly upon the upper quarter of the revolving cylinder. The plane of revolution of these friction-wheels may be changed by an ingenious device controlled by a lever, to be operated by the driver of the car. While the friction-wheels revolve in the same plane as the cylinder, the frame supporting them is at rest, but the moment the axes of the wheels are thrown out of line with that of the cylinder, by a movement of the lever, the frame is driven along the cylinder by the diagonal travel of the wheels, which is similar to that of the travelling ink-distributer on some of the old-fashioned printing-presses. The speed of the car is regulated by the angle of inclination of the friction-wheel axles, the cylinder revolving continuously in one direction at a uniform speed. The feasibility of this system, which at first glance would seem doubtful, has been demonstrated to the satisfaction of those interested by the successful working of a full-size model on a two-hundred-foot track in this city.

SCIENCE:

A WEEKLY NEWSPAPER OF ALL THE ARTS AND SCIENCES.

PUBLISHED BY

N. D. C. HODGES,

47 LAFAYETTE PLACE, NEW YORK.

SUBSCRIPTIONS.—United States and Canada.....$3.50 a year.
Great Britain and Europe..... 4.50 a year.

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Attention is called to the "Wants" column. All are invited to use it in soliciting information or seeking new positions. The name and address of applicants should be given in full, so that answers will go direct to them. The "Exchange" column is likewise open.

VOL. XV. NEW YORK, JANUARY 3, 1890. No. 361

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AMERICAN GEOLOGICAL SOCIETY.

THE annual meeting of this society began Dec. 26, in the new building of the American Museum of Natural History in this city. The result of the election of officers was announced as follows: president, James D. Dana; vice-presidents, John S. Newberry and Alexander Winchell; secretary, John J. Stevenson; treasurer, Henry S. Williams; executive council, J. W. Powell, George W. Dawson, and Charles H. Hitchcock.

Fifteen new fellows of the society were announced as having been elected, and they are as follows: Frank Dawson Adams, lecturer at McGill College, Montreal; Albert Smith Bickmore, American Museum of Natural History; Aaron Hodgman Cole, Hamilton lecturer on natural history at Madison University; Thomas Sterry Hunt of New York City; R. D. Lacoe of Pittston, Penn.; Alfred Church Lane, Houghton, Mich., assistant on Geological Survey of Michigan; Alexander Richard Cecil Selwyn, Ottawa, Canada, director of the Geological and Natural History Survey of Canada; Bailey Willis, Washington, D.C., United States Geological Survey; J. E. Wolff, Cambridge, Mass., instructor of petrography at Harvard; Lorenzo G. Yates, Santa Barbara, Cal.; Victor C. Alderson, Englewood, Ill., teacher of geology; Henry M. Ami, Ottawa, Canada, Geological Survey of Canada; Ezra Brainerd, Middlebury, Vt., president of Middlebury College; Daniel Webster Landon, jun., Cincinnati, O., geologist of the Chesapeake and Ohio Railway; George Clinton Swallow, Helena, Mont., inspector of mines of Montana.

T. C. Chamberlin of Madison, Wis., read a paper upon "Some Additional Evidences bearing on the Interval between the Leading Glacial Epochs," and W. J. McGee of the United States Geological Survey replied briefly. Professor N. S. Shaler of Harvard spoke on "The Tertiary Deposits of Eastern Massachusetts." In his paper, Mr. Shaler endeavored to show that in that district there had been, since the miocene age, a large amount of true mountain-building action at Gay Head, on Martha's Vineyard. The evidence of this had been distinguishable for a long time; but about a year ago it was uncovered, so that it could be better seen than at any previous time, by a most violent rain-storm somewhat in the nature of a cloud-burst. In two hours' time, five and one half inches of water had fallen, and the cliffs at Gay Head had been washed so much that opportunities for investigation were better than ever before. A remarkable instance of dislocations had been exposed, and the formation of the cliffs made plainly visible. The evidences of mountain-building were plain, and it was of a comparatively late period. The same thing could be seen on Block Island. Its limit to the north was sharply defined, for the greensands of Marshfield, Mass., had been examined by Mr. Shaler, and they were perfectly horizontal, and not disturbed. To the south and west investigations had not been pushed: so the extent of the mountain-building in that direction was unknown. Mr. Shaler said further that the evidences of glacial action were plain, and that it must have taken place after the upheaval or mountain-building age.

The second day's session was opened with an address by the present president, Professor James Hall, geologist of the State of New York. Professor Hall's address was a sketch of the earlier geologists, and was directed chiefly to the younger members of the society present. He paid tributes, among others, to Agassiz, Sir Charles Lyell, Professor Logan, the royal geologist of Canada, and William Smith, and closed with a reference to his colleague, Professor Dana.

Professor Edward Orton, State geologist of Ohio, considered the "Origin of the Rock-Pressure of Natural Gas in the Trenton Limestone of Ohio and Indiana." The gas is the product of ages, which has been accumulated in the porous limestone of Ohio and Indiana. It has been produced so slowly that when once exhausted it will take many thousands of years for it to again accumulate in sufficient quantities to be used, even if the elements necessary for its production were present, which he thought was not at all probable. The pressure which forces the gas out with such tremendous power that it sometimes reaches 1,000 pounds pressure per square inch is not due to the pressure of the gas itself, but to the hydrostatic pressure brought to bear by the column of salt water that enters the porous stratum of rock containing the gas, at the sea-level, and which by its weight tends to force the gas out. To the explanation and elucidation of this phenomenon, Professor Orton's paper was more especially devoted. The men who are engaged in the practical development of gas and oil fields, said he, made great account of rock-pressure. It is the first fact they inquire after in a new gas-field. They appreciate its importance, knowing that the distance of the markets they care to reach, and the size of the pipes they can employ, are entirely dependent upon this element. After discussing the theories of its origin, he expressed the opinion that the gas-supply could not be of very long duration. This fact he regarded as of the greater importance on account of the vast extent to which natural gas had become a factor in Western manufacture and development. He said that 400,000 people in north-western Ohio and central Indiana alone depended upon it for fuel and illumination, and that a large proportion of their manufactures depended upon it. The supplies were being wasted in a vandal fashion, and he thought that nine years at most would mark its duration in this region. Artificial gas he believed preferable.

The next paper was by Professor William B. Clark of Johns Hopkins University, his subject being "The Tertiary Deposits of the Cape Fear River Region."

Professor Andrew C. Lawson of Ottawa, Canada, next read a paper entitled "Note on the Pre-Palæozoic Surface of the Archæan Terranes of Canada." Professor William M. Davis of Cambridge, Mass., presented the fourth paper, on "The Structure and Origin

of Glacial Sand Plains." "Glacial Features of Parts of the Yukon and Mackenzie Basins" was the title of the paper submitted by Professor R. G. McConnell of Ottawa, Canada. Professor J. B. Tyrrell of Ottawa, Canada, read a paper on the "Post-Tertiary Deposits of Manitoba and the Adjoining Territories of Canada." Professor G. Frederick White of Oberlin College, Ohio, followed with a paper on "Terminal Moraine in Ontario;" Professor W. J. McGee of Washington, one on the "Southern Extension of the Appomattox Formation;" and Professor Charles D. Walcott of Washington defined the value of the term "Hudson River Group" in geologic nomenclature.

At the concluding sessions on Dec. 28 the number of speakers was so large that a general curtailment was necessary, and papers were withdrawn by the following members: Joseph P. Iddings and George H. Eldridge, Washington, D.C.; C. R. Van Hise, Madison, Wis.; Frank L. Nason, New Brunswick, N.J.; W. O. Crosby; Professor J. E. Wolff of Harvard University; Professor J. F. Kemp, Cornell University; F. J. H. Merrill, New York; H. M. Crump, Persifor Frazer, E. D. Cope, Philadelphia; and Peter McKellar, Ontario.

The paper which provoked the most discussion was read by Professor Alexander Winchell of Michigan University, Ann Arbor, the title of which was "Some Results of Archæan Studies." Those who took part in the discussion were Professor C. H. Hitchcock of Dartmouth, Professor Emerson of Amherst, Professor A. C. Lawson of Ottawa, Canada, and Professor C. R. Van Hise of Madison, Wis.

The first paper of the day was read by Professor H. S. Williams of Cornell, who set forth a new method of illustrating the relation of the history of different regions by graphic representation of the oscillation of sediments, and urged the study of fauna to bring out the relation of local fauna to their ancestors.

Professor G. H. Williams of Johns Hopkins University exhibited and described some specimens highly metamorphosed, but still containing fossils, collected in Norway. C. D. White of Washington claims to have found fossils showing rock on Martha's Vineyard to be middle cretaceous in place of middle tertiary, as supposed. J. S. Diller of Washington projected upon the screen photographs of dikes in California. In some cases the dikes were five feet wide and twenty feet high. Professor A. S. Richmond then projected some Alaskan views, and a diagram of the buildings that would be erected on the museum ground for the world's fair of 1892.

Professor C. H. Hitchcock of Dartmouth read an interesting paper on "Granitoid Oval Areas in the Laurentian," and Professor B. K. Emerson of Amherst spoke on "Porphyritic Granite." Professor A. C. Lawson of Ottawa read a paper on the "Archæan of Central Canada." Then followed papers by Professor Warren Upham, President James Hall, and F. J. H. Merrill.

The next meeting of the society will be in Indianapolis, Ind., August, 1890.

BOOK-REVIEWS.

Scientific Papers of Asa Gray. Selected by CHARLES SPRAGUE SARGENT. 3 vols. Boston and New York, Houghton, Mifflin, & Co. 8°. $3 per vol.

THE general public will, we are sure, be much surprised to learn that Professor Gray was so voluminous a writer as these volumes show him to be. Indeed, Mr. Sargent, in his introduction, states that his contributions to science were so numerous and varied as to astonish those of his associates who were most familiar with his intellectual activity, his various attainments, and that surprising industry which neither assured position, the weariness of advancing years, nor the hopelessness of the task he had imposed upon himself, ever diminished. His first scientific paper was published in 1834, and his last was written in 1887, but a few weeks before his death. During this half-century it may truly be said that his pen was never idle. In the selection of Professor Gray's writings for republication, Mr. Sargent omits those contributions which are devoted to descriptive botany, and many of which form the best textbooks in the English language; nor does he attempt to reproduce the philosophical essays which grew out of the discussion of the Darwinian theory. Reviews, biographical notices, and a few essays upon subjects of general interest to botanists, all of which have long been out of print, form the greater part of the volumes before us. It was doubtless a most difficut task to select from so much material that which was most desirable to publish. More than eleven hundred bibliographical notices and reviews, all of them from the hand of such a critic as Asa Gray, must indeed have been an *embarras de richesses.* Mr. Sargent's plan has been to present in his selection, as far as possible, a history of the growth of botanical science during a period which has been marked by the gradual change of ideas among naturalists upon the origin and fixity of the species which has broadened the field of all biological investigation, by the establishment and systematic arrangement of vast herbaria gathered from all parts of the world, by the introduction of improved and more philosophical methods of investigation in the laboratory, and by the growth of popular appreciation for the value of scientific training. The task which Mr. Sargent set out for himself was a most arduous one; but so well has he performed it, that the whole scientific world has been made his debtor. The future reputation of Asa Gray will be enhanced by the presentation of his writings; and the editor of them will always have the satisfaction of knowing that he has in no inconsiderable degree assisted in preserving the lustre of the name of Asa Gray.

AMONG THE PUBLISHERS.

ON Saturday, Feb. 1, 1890, the Illustrated American Publishing Company (New York) will issue the first number of a weekly news magazine, which, it is claimed, will "rival the most artistic periodicals of England, France, and Germany, and surpass those produced in this country." The illustrations will be the picturesque chronicling of contemporaneous history. A colored supplement will be the most conspicuous feature of every number. It will be a facsimile, in color, of the masterpiece of some celebrated painter, in the preparation of which the discoveries in the art of reproduction will be employed. *The Illustrated American* is designed for the home. It will be unsectarian, and free from political discussions and heavy debates. The serial novel and short stories will be illustrated, and other matter will be selected to afford amusement, entertainment, and valuable information.

— *St. Nicholas* for January is a second Christmas number. Walter Camp's foot-ball paper deals with the great games at the Polo Grounds, and is re-enforced by a study of "The Drop-Kick," contributed by Yale's famous expert, W. T. Bull, whose kicks won Yale a championship. A story of New-Mexican life, by Charles F. Lummis, gives the legend of the now inaccessible "Enchanted Mesa," upon which, tradition says, there is a deserted village just as it was left hundreds of years ago. A photograph of the mesa from nature is one of the illustrations.

— Messrs. Macmillan & Co. will shortly publish the first part of Professor Eimer's work on "Organic Evolution as the Result of the Inheritance of Acquired Characters according to the Laws of Organic Growth," translated by J. T. Cunningham, M.A., F.R.S.E., late fellow of University College, Oxford, England.

— After Mr. Gladstone, Pope Leo XIII. is the most vigorous man of his age of the day, says Edward W. Bok, in the January *Ladies' Home Journal.* The routine of his work would kill an ordinary man. There is no detail too small for him to pass over; and from daybreak until after midnight he devotes his time to the church and literature. Those who surround him know when he is particularly tired or worn out, for then he takes down a volume of Dante, and reads with the avidity of a school-girl enjoying her first novel. Of all the authors, Dante is the Pope's favorite, and it has been remarked that in physique he is not unlike the accepted idea of that great Italian. He reads Dante for pleasure; but, for keeping himself well informed on all that is happening out of the church as well as in it, he reads not only American books, but newspapers and magazines; and it may surprise American readers to know that he is well informed on all the topics of the day, political, religious, and social. He has taken a deep interest in the cause of labor in the United States, and reads every thing bearing on that

subject which comes to hand. Once a week a well-selected bundle of American newspapers is sent to the Vatican; and the Pope and those that surround him know not only what is going on in the United States, but they are familiar with the calibre and character of the men who make laws and enforce them. It is so in England also. In addition to his correspondence in the British Empire, he follows with eager interest the reports in the various newspapers, not only of the doings of Parliament, but of royalty as well, the progress of the church, and the cause of labor. Much the same plan is followed in Germany; in fact, from every corner of the world each week is sent to the Holy Father newspapers, books, and magazines containing important discussions. A great many of these are filed away for future reference. The books that interest Leo the most are those of a religious, political, and philosophical nature. He cares nothing for fiction, and rarely spends an hour in glancing at novels; but if he should like to read novels, or, in fact, books of any kind, he has only to walk into the magnificent library attached to the Vatican, for there is not a mail arriving in Rome that does not bring books of all sorts of types from all sorts of authors and publishers. A great many of these the Pope never sees, and many of them are sent to the cardinals who surround him for an opinion of their merits or demerits. But it may be said, taking it all in all, that the Pope has as wide a field to select from as, if not wider than, any man in Europe; and he resembles Mr. Gladstone in this, that he is quite willing to spend an hour or more with a magazine or book, if in the end he can find something that is worth remembering. He has a wonderful memory, and, although his eyes are dimmed and his hand trembles, he is still as vigorous mentally as he was when he was elected to succeed Pius IX.

— Part V. of the "New English Dictionary," edited by Dr. Murray, has just appeared from the Clarendon Press. It comprises the words from "cast" to "clivy," and contains, in all, 8,371 words, of which 5,966 are "main words." It comprises all the words beginning with *ch*, which, as the editor remarks, "contains more words than *j*, *k*, or *q*, and more than *x*, *y*, and *z* put together." Many of the words here dealt with have an interesting form-history, which is treated with the same fulness and accuracy that have characterized all previous work of the kind in this dictionary. The verb "cast" fills five pages, — the largest space required by any word yet reached; and the other strong verbs, of which the present instalment contains quite a number, are treated with similar fulness. The scientific terms comprise the important groups beginning with "cerebro-," "chalco-," "chiro-," "chloro-," together with many others. One of the most interesting features of this part of the dictionary is the large group of words relating to the Christian church, including "Christ" and its derivatives, "church," "catholic," "clergy," "cherub," and many more, all of which are treated with great fulness of detail and wealth of illustration. It is somewhat singular that the origin of "church" is still uncertain, the derivation from Greek, κυριακόν, meaning "of the Lord," which the editors adopt, being admittedly uncertain. The system of spelling and pronunciatiou adopted in the dictionary, though not always such as we should prefer, is in the main judicious, and remarkably free from hobbies. To criticise such a work as this would require almost as great a combination of talents and information as has been employed in its preparation, while to praise it is superfluous; and we will therefore commend it anew to our readers without further comment.

— The January *Magazine of American History* opens its twenty-third volume. A portrait of William Cullen Bryant forms the frontispiece, and a paper by the editor treats of his place in American history. "A Rare Picture of Early New York," painted on the panel of an old Dutch war-vessel, a view never before published, is a contribution from the collector Dr. Thomas Addis Emmet. "Uncle Tom's Cabin and Mrs. Stowe," an extract from the new work of Mrs. McCray, is entertaining, and is also illustrated; then from Hon. J. O. Dykman there is a sketch of "St. Anthony's Face" on the Hudson, with a picture of that piece of natural sculpture. Of interest for every thoughtful reader is the study, by Hon. Gerry W. Hazleton of Milwaukee, entitled "Federal and Anti-Federal;" next following, Hon. James W. Gerard shows, in the longest paper of the number, "The Impress of Nationalities upon the City of New York." A paper, "Ralph Izard, the South Carolina Statesman," comes from the pen of Dr. Manigault of Charleston, which, with "American Republics — Their Differences," by George W. Pavey, completes the group of contributions.

— The January issue of *The Quarterly Journal of Economics*, published for Harvard University, will contain articles by Professor Hart of Harvard, on American cities, discussing their rise, the causes of their growth, their population, the foreign element; by Professor Hadley of Yale, on the effects of the prohibition of pools by the Interstate Commerce Act; by Professor Giddings of Bryn Mawr, on the theory of interest, a solid contribution to economic theory; by E. Cummings, describing the exhibition on social subjects at the Paris Universal Exposition; and by A. de Foville of Paris, on the economic movement in France, the revival of the protectionist feeling, and the legislation on railroads. In addition, there will be varied notes and memoranda, and the usual bibliography of recent economic publications.

— E. & F. N. Spon have just issued a third edition of "Brown's Manual of Assaying Gold, Silver, Copper, and Lead Ores," by Walter Lee Brown, B.Sc., thoroughly revised and corrected. This manual is a 12mo of 488 pages, with 94 illustrations, colored plate, and flexible covers. It is devoted to the assaying of the ores of the four metals mentioned, but principally to those of gold and silver. Every step is clearly defined, from the crushing of the rough ore to the weighing of the final particle of gold obtained. The important features of this, as compared with the first edition, are, increase in matter and illustrations; the expansion of the crucible process to almost ninety pages; full charges in the scorification process; detailed notes on the colors of scorifiers (with a colored plate) and cupels, after work; the stating of all charges in assay tons, grams, and grains; and more complete articles on the assay of gold and silver bullion, and volumetric analysis of copper ores. The book is a practical treatise, free from technicality, and as such will be of value to every one interested in mining or assaying, whether an expert or an investigator.

— We have received from C. W. Bardeen of Syracuse, N.Y., a series of "Papers on School Issues of the Day," Nos. I.–VII. They were originally read at the meeting of the National Educational Association at Nashville, Tenn., last July, and contain much interesting matter. The largest of the pamphlets, and the one most likely to attract attention, is that on "Denominational Schools," being a discussion by Cardinal Gibbons and Bishop Keane of the Roman Catholic Church on the one side, and Edwin D. Mead and John Jay on the other. The ablest part of the discussion, in our opinion, is the essay by Mr. Mead, who has evidently given the subject a good deal of thought and study; but the Roman Catholic view of the subject was ably presented by Bishop Keane, and there are many points of interest in Mr. Jay's paper. All persons interested in the subject should read this pamphlet. The two next of the papers before us are by William T. Harris, on "The Educational Value of Manual Training," and on "Art Education the True Industrial Education." The former is the report of a committee appointed at a previous meeting of the Educational Association, of which Mr. Harris was chairman. It deals but little with the economic aspects of manual training, and treats of its educational or disciplinary value only, which it deems of a low order. The paper on "Art Education" is the work of Mr. Harris himself, and insists on the importance of artistic training of a high order, even for industrial purposes. The paper on "Methods of Instruction and Courses of Study in Normal Schools," by Thomas J. Gray, is largely technical, and therefore of less general interest than some of the others; but it was highly commended by those who listened to it. B. A. Hinsdale discussed the subject of "Pedagogical Chairs in Colleges and Universities," maintaining the importance of such chairs and their appropriateness in such institutions. The last of our pamphlets is by Charles Foster Smith, on "Honorary Degrees as conferred in American Colleges." The author shows that such degrees are now conferred without regard to merit or achievement, and rightly holds this to be a pernicious practice; but he has little that is new to suggest in the way of remedy. All these papers give evidence of the recent awakening of thought in this country on educational themes.

— "Beneath Two Flags," by Maud B. Booth, just published by Funk & Wagnalls, New York, is partly an explanation, and partly a vindication, of the Salvation Army. The author is the wife of Marshal Booth, who is the son of Gen. William Booth, founder and leader of the whole movement.

— *The Sidereal Messenger* is devoted wholly to astronomy, and is issued monthly except for July and August. It is announced that it will hereafter contain articles in each number from "some of the best American and English astronomers, with expensive illustrations when desirable or necessary." Most of these articles will be in popular language, and adapted to the wants of scholars in other lines of scientific research. The article in the December, 1889, number by Professor Asaph Hall, United States Naval Observatory, Washington, D.C., entitled "The Resisting Medium in Space," though necessarily somewhat mathematical in form, is an admirable presentation of the present state of knowledge on this important theme. The feature of "Current Celestial Phenomena" will be "kept full, timely, and interesting." The addition of "Astronomical Bibliography" will be "a feature that all scholars will prize." "The Astronomical News and Notes" will be in the future "more varied and general, aiming to give as complete a history of astronomical work and progress as can be secured from month to month." The attention of all interested in astronomical science is called to this publication as adapted to the wants of (1) those who are teachers or students of astronomy; (2) those in charge of astronomical observatories; (3) those in charge of reading-rooms, and of all public and private libraries. It is published by William W. Payne, Carleton College Observatory, Northfield, Minn.

LETTERS TO THE EDITOR.

***Correspondents are requested to be as brief as possible. The writer's name is in all cases required as proof of good faith.*

The editor will be glad to publish any queries consonant with the character of the journal.

On request, twenty copies of the number containing his communication will be furnished free to any correspondent.

Unconscious Bias in Walking.

THE question is again raised as to the cause of the deviations from a right line in walking with the eyes closed, or in the dark, in the letter to the editor with the caption "Is Man Left-Legged" (*Science*, xiv. p. 412). Several theories have been advanced to account for the frequently observed phenomena referred to, which may be briefly stated as follows: —

1. The legs are not of equal strength, and the strongest outwalks the other, making a curve to the opposite side.

2. The relative dexterity with which the legs are used; some persons being right-legged, and others left-legged, regardless of strength or length. It is probable, however, that there will be the greatest dexterity with the strongest limb; and, if so, this is only another form of the first theory.

3. The legs are not of equal length, and a person will take the longest step *with* the longest leg.

4. The legs are not of equal length, and a person will take the longest step *from* the longest leg.

In the last two theories, it will be observed, opposite conclusions are reached from the same assumed facts.

Several years ago I made a careful series of experiments with forty-nine young men to test the correctness of these theories. Their legs were accurately measured to determine the length, and a dynamometer was used to ascertain the relative strength. The curves representing their bias in walking when blindfolded were accurately traced and plotted on a diagram, so that they could be readily compared and studied.

The results of these experiments (published in *Nature*, July 30, 1885) were as follows: Of five cases in which there was no bias, in two the right leg was longest (in one of these the right leg was strongest, and in one the strength of the legs was not tested), — one presented the greatest difference in length of legs, and the other more than the average of those with right leg longest, — and in three the legs were of equal length (in one of these the right leg was strongest, and in two the left leg was strongest (*a*)). Four were right-handed: one used right and left with equal dexterity (*a*). In pointing at a distant object with both eyes open, in three the right eye was dominant, in one the left eye was dominant, and in one both eyes were apparently used to determine the range. Of fourteen cases in which the bias was to the right, in five the right leg was longest (in two the right leg was strongest, in two the left leg was strongest, and in one the strength of the legs was not tested), in four the left leg was longest (in three the right leg was strongest (*a*), and in one the left leg was strongest), and in five the legs were of equal length (in two the right leg was strongest (*a*), and in three the left leg was strongest). All were right-handed. In pointing at a distant object with both eyes open, in twelve the right eye was dominant, and in two the left eye was dominant, the latter in the groups marked (*a*). Of thirty cases in which the bias was to the left, in eight the right leg was longest (in five the right leg was strongest (*a*) (*b*), in two the left leg was strongest, and in one the legs were of equal strength), in ten the left leg was longest (in five the right leg was strongest (*b*), in four the left leg was strongest (*b*), and in one the legs were of equal strength), and in twelve the legs were of equal length (in five the right leg was strongest, in five the left leg was strongest (*b*), and in two the strength of the legs was not tested). One was left-handed (*a*), twenty-five were right-handed, four used right and left with nearly equal dexterity (*b*). In pointing with the finger at a distant object with both eyes open, in twenty-two the right eye was dominant, in six the left eye was dominant, and in two both eyes were apparently used to determine the range.

From the facts here presented, it is evident that the relative length or strength of the legs cannot be assigned as the cause of the observed bias in walking. The phenomena in question can, however, be readily explained by the application of well-established physiological principles.

When walking in a straight line, the muscles of locomotion are made to act in orderly correlation through impressions received by the senses and conveyed to the nervous centres, and thence transmitted to the muscles by the motor nerves.

When a person is blindfolded, or in the dark, or in a mist, the senses cannot serve as guides to direction, and the muscles of the two sides of the body may not act with the same energy, from differences in nutrition, or from lack of co-ordinating impulses from the nervous centres; that is to say, an exact equilibrium in the muscular activity of the two sides of the body can only be secured through the co-ordinating influence of the senses acting through the nervous system. When this directive agency is not available, a divergence from a direct course will, in most cases, follow from a lack of bilateral symmetry in the functional activity of the muscles.

MANLY MILES.

Lansing, Mich., Dec. 26.

The Influence of Baking-Powder Residues on Digestion.

THERE has always been more or less discussion over the question of what a pure baking-powder should consist, and which of the constituents of many kinds of baking-powders are most deleterious to the human system.

The manufacturers of different brands of powders obtain indorsements from eminent chemists that theirs is the only powder on the market which does not exert a harmful effect when taken every day in our food.

What one manufacturer calls an adulteration another claims is beneficial to the health, when taken in small quantities. This is especially true in the case of the animated discussion in the newspapers at the present time between the manufacturers of the various phosphate baking-powders and those who produce a powder made of bicarbonate of soda and cream-of-tartar.

The manufacturers of the latter brands advertise that theirs does not contain any calcium phosphate, and look upon this compound as an adulterant; while the firms interested in the sale of the former brands laud the use of phosphates in food, at the same time claiming that the bicarbonate of soda and cream-of-tartar form, after baking, a residue of Rochelle salts, the constant introduction of which daily into the stomach would prove very deleterious to the action of the gastric juice.

While these claims are made by the different manufacturers merely for the purpose of selling their own goods, and consequently the harmfulness of their rivals' products greatly overdrawn, yet in a measure the claims of both are true.

That all baking-powders have, to a greater or less degree, a retarding action on digestion by reason of the difficultly soluble salts left as residues after the process of baking, no one doubts; but now the question arises, "Which of the constituents used in the manufacture of baking-powders have the least injurious effects?"

In order to learn what were the most common adulterants of baking-powders, the writer made a tour of many grocery-stores in the city of New Haven, and was enabled to purchase thirteen different brands. In all cases it was found that the cheaper brands, and those offering inducements to the poorer classes by reason of their gifts of household articles, etc., with the purchase of their powders, were adulterated to by far the greatest extent.

The adulterations in some of these cases were not of a harmful character in themselves; e.g., starch was used in a very liberal quantity on account of its being so much cheaper than bicarbonate of soda and cream-of-tartar.

The only ill effect produced by the use of starch is, that, the strength of the powder being lessened so much by the absence of the proper amount of bicarbonate of soda, the housekeeper is forced to use a great quantity of the powder in order to cause the liberation of carbonic-acid gas necessary for the lightness of the bread or pastry. Thus the stomach gets a greater dose of impurities, which generally occur in a powder adulterated with starch, than it would from a powder not containing the latter ingredient.

Of the thirteen brands of powder examined, eight contained large quantities of alum; and two more, traces. Six contained calcium phosphate; two of which, however, were labelled "phosphate powders," but in the other cases it was used as an adulteration.

One of the phosphate powders contained a great quantity of alum, although it claimed to be free from it. All contained more or less starch, but the better brands use only a very small quantity of it, for the purpose, they claim, of keeping the powder from being decomposed by the moisture. *Terra alba*, or "white earth," was found as a common adulterant of the cheaper powders; and, while it is claimed that it is so insoluble that it passes through the body unchanged, yet, accepting that, the same thing may be said of it as has been said of the use of a large quantity of starch; viz., that a larger amount of the powder must be used to produce the required porosity in the bread, thus increasing the amount of residue.

It was the object of this investigation not only to find out the influence the residues of impure baking-powders have on digestion, but also to find out to what extent, if any, the residues of the purest made powders retard the digestive action of the gastric juice.

Regarding the use of alum as an adulterant, Dr. Mallét of the University of Virginia has just made a careful investigation, and finds that its use is very harmful, as it does not retain its form as a sulphate, but, on being subjected to the process of baking, assumes the highly insoluble form of aluminium hydroxide.

By quantitative work with this latter compound, and also by means of taking a large dose of it after a hearty meal and noting the result, he has found that digestion is impaired, and proves that this result is due to the fact that the aluminium unites with the acid of the gastric juice, thus depreciating the effectiveness of the latter secretion; also that part of the organic matter of the food is precipitated in an insoluble form by the presence of the aluminium compounds.

Accepting, then, this well-proved and universal belief that alum is deleterious to the human system, a series of experiments were begun to find out what other salts used in the preparation of baking-powders exert a harmful effect on the digestive process.

For these experiments, an artificial gastric juice was prepared by dissolving .05 of a gram of scale pepsin in a solution of .4 of one per cent hydrochloric acid.

In the first series, egg-albumen was taken as the material to be digested, after freeing it from globulin by precipitating the latter with a few drops of hydrochloric acid.

The first experiment was undertaken to determine what effect the purest made baking-powder has on digestion; the one which stood the best tests in the previous analysis being chosen, as it contained only the bicarbonate of soda and pure cream-of-tartar.

Three digestions were carried on at the same time and under the same conditions. The first was the control or normal digestion, in which 10 cubic centimetres of albumen, 40 of distilled water, and 50 of the artificial gastric juice, were used. In the second 1 gram of the baking-powder was heated with the 40 cubic centimetres of water for a short time at a temperature of 100° C., to give it the same conditions it would have in baking bread; then the starchy residue was filtered off, and the same amounts of gastric juice and albumen added as were used in the control. The third was treated in the same manner as the second, except that 2 grams of the baking-powder were used.

The three digestions were then carried on in a 40° C. water-bath, thus giving the digestion normal temperature.

After stirring well at different periods, the digestions were stopped, after five hours had elapsed, by raising their temperature above 70° C., and killing the ferment. All were neutralized with a dilute solution of sodium carbonate, filtered through a weighed filter, washed well with hot water, and, after drying in an oven, the precipitate was weighed.

If none of the albumen had been digested in any case, the precipitate should weigh 1 gram, for 10 cubic centimetres of egg-albumen yield (with slight variations) 1 gram. The following figures, however, representing the weight of the precipitates, show how far digestion had proceeded in each case: No. 1, or control, .3065; No. 2, 1 gram of powder, .6495; No. 3, 2 grams of powder, .7570: in other words, the amounts digested in grams would be, No. 1, .6935, or 100 per cent; No. 2, .3505, or 50½ per cent; No. 3, .2324, or 33⅓ per cent.

Regarding the normal amount digested as 100 per cent, the amounts digested in the other cases are thus deduced.

While the inhibitory action of this residue seems to be very great on studying these figures, it must be remembered that only a small amount of albumen was used in comparison with the amount of baking-powder; but these results only go to show that even the "purest" baking-powder retards digestion in a measure.

To avoid the trouble with the starchy sediment that occurs with the baking-powder, a second series of experiments was undertaken with different amounts of the pure Rochelle salts, which is the residue formed by the action of cream-of-tartar on bicarbonate of soda in baking. The same amount and strength of gastric juice were used in this series as in the first, and also the same amount of albumen. The following table shows the result obtained after digestion had proceeded seventeen hours:—

	Grams of Salt used.	Weight of Precipitate.	Grams digested.	Per Cent digested.
No. 1	0.0	.2263	.7737	100.0
No. 2	0.1	.2398	.7602	98.2
No 3	0.5	.3314	.6686	86.4
No. 4	1.5	.7347	.2653	34.2
No. 5	2.0	.7575	.2425	31.3

Three other series were carried through to verify the result obtained in this experiment, and the amount digested in any case was found to be fairly constant with the amount of salt used.

A series of digestions was then carried on with the use of ammonium alum to show what effect this salt has on digestion in its unchanged form of a sulphate, and it is interesting to note that its inhibitory action is not very much greater than the Rochelle salts.

The following table shows the result obtained after digestion had been carried on five hours:—

	Grams of Salt used.	Weight of Precipitate.	Grams digested.	Per Cent digested.
No. 1	0.0	.4021	.5979	100.0
No. 2	0.1	.5496	.4504	75.3
No. 3	0.8	.7079	.2921	48.8
No. 4	1.0	.7128	.2872	48.0

The next residue experimented with was the one which is left in the cooked food when a baking-powder adulterated with calcium phosphate and alum, or an ordinary phosphatic powder containing alum, is used; i.e., aluminium phosphate.

The results obtained in this series, when compared with those of the Rochelle salts, or even with the alum, show a greater inhibitory power than either, and go to show that the occurrence of alum and calcium phosphate in the same powder forms a residue which greatly retards digestion.

The results after digestion had been carried on fifteen hours were as follows:—

	Grams of Salt used.	Weight of Precipitate.	Grams digested.	Per Cent digested.
No. 1	0.0	.1651	.8349	100.0
No. 2	0.1	.2889	.7111	85.1
No. 3	1.0	.6323	3477	41.6

In order to obtain a correct comparison between the inhibitory effects of a baking-powder made from bicarbonate of soda and

cream-of-tartar, and one made by substituting calcium acid phosphate for the cream-of-tartar, two different amounts of Rochelle salts and calcium acid phosphate were used, and each subjected to the same conditions.

The difference in the retarding action of these residues is easily seen from the following table (digestion carried on five hours) : —

	Grams of Salt used.	Weight of Precipitate.	Grams digested.	Per Cent digested.
No. 1	0.0	.3441	.6559	100.0
No. 2	0.5 (Rochelle)	.5678	.4322	65.9
No. 3	1.0 (Rochelle)	.7700	.2300	35.0
No. 4	0.5 ($Ca H_4 (PO_4)_2$)	.8220	.1780	27.1
No. 5	1.0 ($Ca H_4 (PO_4)_2$)	.8852	.1148	17.5

The superiority of cream-of-tartar over calcium acid phosphate as the acid principle of a baking-powder is shown very well in this last experiment; and, although it is claimed that the latter form of powder furnishes the necessary phosphates for building up the bone-tissue of the body, yet this benefit is rather overbalanced by the harm done by the retardation of the digestive process.

In some cases where it was desirable to compare the effects of two baking-powders directly, or in cases where insoluble salts were used, time digestions were resorted to, in order to avoid loss in neutralizing and filtering.

For these experiments 20 grams of coagulated albumen, and 200 cubic centimetres of artificial gastric juice, were employed.

The digestions were carried on in a 40° C. water-bath, stirred well, and observations made regarding the time of disappearance of the coagulated albumen in each digestion.

In the first series, three amounts of a phosphate baking-powder were used, and, as in previous experiments, a control free from powder.

	Grams of Powder.	Time (hours) to digest.
No. 1	0.0	22
No. 2	0.5	30
No. 3	1.0	42
No. 4.	1.5	50

Having obtained the datum in a previous experiment that a phospate powder adulterated with alum had great retarding action on digestion, a comparison was made between a pure phosphate powder and one known to contain alum; and, although the digestion was not carried on until all of the coagulated albumen had disappeared, yet it was carried far enough to enable the observer to make a good comparison. No. 1 contained no salt; No. 2, .5 of a gram of pure phosphate powder; No. 3, 1 gram; No. 4, 1.5 grams; No. 5, .5 of a gram of impure phosphate powder; No. 6, 1 gram; No. 7, 1.5 grams.

The albumen in No. 1 was first to disappear, followed closely by No. 2, then a little later by No. 5; and so on, in every case the one containing the pure phosphate powder digesting before the one containing a similar amount of impure powder.

Ammonium carbonate has been put down by some as inhibiting digestion, but others claim that on baking it volatilizes and goes off as ammonia gas, leaving a harmless residue; but, in fact, only a small portion of the whole is driven off in this way, for the ammonia forms a compound of ammonium tartrate immediately on heating, and this latter salt is not easily decomposed by heat.

To discover the relative inhibitory action of this residue on digestion, a series was made, using comparative amounts of aluminium phosphate, Rochelle salts, and ammonium tartrate. No. 1 contained no salt; No. 2, .5 of a gram of aluminium phosphate; No. 3, 1 gram; No. 4, .5 of a gram of Rochelle salts; No. 5, 1 gram; No. 6, .5 of a gram of ammonium tartrate; No. 7, 1 gram.

No. 1 was digested in about 45 hours, followed closely by No. 6, and the remaining ones digested in the following order: Nos. 4, 7, 5, 2, 3.

As far as could be seen from this series, there is very little difference in the inhibitory powers of the Rochelle salts and the ammonium tartrate; and the latter cannot be considered, therefore, to be more harmful than the residue of a pure baking-powder.

As a summary of the facts brought out by this investigation, we find (1) that the residues of all baking-powders, no matter how pure may be their constituents, have a harmful effect on digestion, due, in all probability, primarily to the fact that the salts are acted upon by the hydrochloric acid of the gastric juice with the formation of more soluble compounds, and, secondarily, that these salts may form organic compounds with albuminous bodies in the same manner as many of the metals do; (2) that calcium phosphate, on account of its great inhibitory action on digestion, must be regarded as a poor agent for the manufacture of a baking-powder, while ammonium tartrate may be looked upon with more favor; (3) that the presence of alum in a powder made with calcium phosphate greatly increases its retarding action; (4) that the least harmful baking-powder is one containing only the bicarbonate of soda and cream-of-tartar, and that the presence of any other chemical substance, however harmless it may be in itself, tends only to increase the complexity of the residue and impair the activity of the gastric juice.

R. TAYLOR WHEELER.

Jersey City, N.J., Dec. 24.

Resemblance of People.

WHILE in Chicago during the Republican convention of the summer of 1888, it occurred to me to make an estimate of the number of people that must be taken, in order that there may be in general two persons who look enough alike for the resemblance to be noticed at first glance, taking account only of the features, and not of characteristics of voice, motion, etc., which of course help us very much to distinguish persons.

Posting myself upon a street-corner so as to face the moving crowds of people, and throwing myself into as passive a condition as possible, I gazed intently upon the passing faces. Out of 700 persons tried, 29 brought to mind some acquaintaince. I estimated the number of available acquaintances at 5,000 at least, for among the number suggested some could scarcely be called acquaintances. This would indicate, that, among 120,000 people, one will likely be found to resemble any one person enough to be noticed at a glance; or among $\sqrt{120{,}000}$, i.e., about 400 persons, two will probably be found to resemble enough to be noticed at a glance. Of course, the result depends upon one's memory of faces and the ease with which faces are distinguished, and undoubtedly upon many other things.

W. S. FRANKLIN.

Lawrence, Kan., Dec. 23.

A Remarkable Bowlder of Nephrite or Jade.

THE writer lately obtained in southern Oregon a bowlder of jade, which is the largest erratic mass of the mineral yet found on this continent. It was found among the auriferous gravel of a stream near a small mining hamlet by a gold prospector. Its color is of a mottled deep leek green, interspersed with veins of light green and yellow. It is turtle-back in form, and weighs 47½ pounds avoirdupois. To the eye it is semi-translucent, splintery, and fibrous in its structure; but that it is remarkably compact and homogeneous in character, is attested by a blow, when it produces a clear metallic ring like bell-metal. The specific gravity of three small chips taken from different parts of the bowlder is 2.949, 3.01, 3.04, the difference being probably due to the variance of magnetite in the pieces. The extremes correspond nearly with those given by Dr. Fischer (*Nephrit und Jadeit*, p. 54, Stuttgart, 1880) and by Clarke (*Proceedings of the United States National Museum*, p. 116, 1888). This occurrence of nephrite bowlders among the river-gravel of our Western coast streams, in connection with Mr. G. M. Dawson's (*Science*, xi. p. 186), tends to confirm the belief that it was found by the native races of that coast in sufficient quantities from which to manufacture their various implements of jade.

JAMES TERRY.

New York, Dec. 30.